

Cumulative AP Practice Test 1 Solutions

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AP1.15 (a) The distribution of gains for subjects using Machine A is roughly symmetric while the distribution of gains for subjects using Machine B is skewed to the left (towards the smaller values). The center of the distribution of gains for subjects using Machine B (median = 38) is greater than the center of the distribution of gains for subjects using Machine A (median = 28). The distribution of gains for subjects using Machine B (range = 57, $IQR = 22$) is more variable than the distribution of gains for subjects using Machine A (range = 32, $IQR = 15$). Overall, the cardiovascular fitness gains using Machine B tend to be higher than those for Machine A.

(b) The company should choose machine B if they want to advertise it as achieving the highest overall gain in cardiovascular fitness. The median gain for Machine B (38) is greater than it is for Machine A (28), as is the mean ($\bar{x}_B = 35.4$ versus $\bar{x}_A = 28.9$).

(c) The company should choose Machine A if they want to advertise it as achieving the most consistent gains in cardiovascular fitness. Machine A exhibits less variation in gains than does machine B. The IQR for Machine A (15) is less than the IQR for Machine B (22). Additionally, the standard deviation for Machine A (9.38) is less than the standard deviation for Machine B (16.19).

(d) Volunteers were used for the experiment and these volunteers may be different in some way from the general population of those who are interested in cardiovascular fitness. Also, the experiment was conducted at only one fitness center. Results may vary at other fitness centers in this city and in other cities. If the company wants to broaden their scope of inference, they should randomly select people from the population they would like to draw an inference about.

AP1.16 (a) Number the 60 retail sales districts with a two-digit number from 01 to 60. Using a table of random digits, read two-digit numbers until 30 unique numbers from 01 to 60 have been selected. These 30 districts are assigned to the monetary incentives group and the remaining 30 to the tangibles incentives group. After a specified period of time, record the change in sales for each district and compare the mean change for each of the treatment groups to see if there is a difference.

(b) Using the digits provided, the districts labeled 07, 51, and 18 are the first three to be assigned to the monetary incentives group.

(c) It would be better to use a matched pairs design. There could be a large variation among the sales figures for the districts due to the various sizes of those districts across the different regions of the United States. Matching the districts based on their size accounts for the variation among the experimental units due to their size on the response variable—sales volume. Pair the two largest districts in size, the next two largest, down to the two smallest districts. For each pair, pick one of the districts and flip a coin. If the flip is “heads” this district is assigned to the monetary incentives group. If it is “tails,” this district is assigned to the stangible incentives group. The other district in the pair is assigned to the other group. After a specified period of time record the change in sales for each district and compare within each pair.

AP1.17 (a) There is a very strong, positive, linear association between sales and shelf length.

(b) $\hat{y} = 317.94 + 152.68x$, where y = weekly sales (in dollars) and x = shelf length (in feet).

(c) $\hat{y} = 317.94 + 152.68(5) = 1081.34$. If five linear feet of shelf space were allocated, the predicted sales would be about \$1081.

(d) The value $s = 22.9212$ is the standard deviation of the residuals. When using the least-squares regression line with x = shelf space to predict y = sales, we will typically be off by about \$23.

(e) $r^2 = 0.982$. About 98.2% of the variation in weekly sales revenue can be accounted for by the linear model relating sales to shelf length.

(f) It would be inappropriate to interpret the intercept, because the data represent sales based on shelf lengths of 3 to 6 feet and 0 feet falls substantially outside that domain. This would be an extrapolation beyond the data we have.